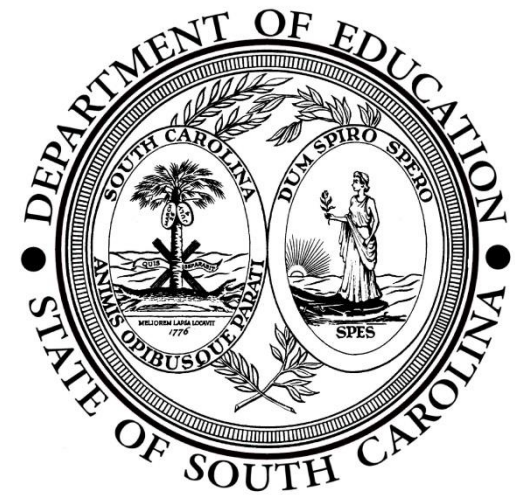# South Carolina College- and Career-Ready Standards for Mathematics
7th Grade Support Document

South Carolina Department of Education
Office of Standards and Learning
September 2015 - DRAFT

South Carolina College- and Career-Ready Standards for Mathematics
Grade 7 Overview

The Table of Contents below arranges the *South Carolina College- and Career-Ready Standards for Mathematics* for middle school into *Course Coversheets* and *Units*.

- Each middle school *Course Coversheet* organizes the middle school course standards into <u>possible</u> instructional units and provides links to specific middle school course *Units*.
- Each middle school course *Unit* contains:
    - o Clarifying notes related to the standards within the unit
    - o New academic vocabulary in the unit
    - o Prior and subsequent knowledge related to the unit
    - o Description of the relationship between the standards in the unit
    - o <u>Potential</u> instructional strategies and lessons
    - o Resources for the unit
    - o <u>Sample</u> formative assessment tasks and questions

Table of Contents

Unit	Standards	Support Document		
Rational Numbers	7.NS.1 7.NS.2 7.NS.3	Content Standards with Clarifying Notes	Prior Knowledge Required for this Unit	Potential Instructional Strategies/Lessons
		New Academic Vocabulary	Subsequent Knowledge Related to this Unit	Resources
			Relationship Among Standards in this Unit	Sample Formative Assessment Tasks/Questions
Expressions and Equations	7.EEI.1 7.EEI.2 7.EEI.3 7.EEI.4 7.EEI.5 7.NS.4	Content Standards with Clarifying Notes	Prior Knowledge Required for this Unit	Potential Instructional Strategies/Lessons
		New Academic Vocabulary	Subsequent Knowledge Related to this Unit	Resources
			Relationship Among Standards in this Unit	Sample Formative Assessment Tasks/Questions
Ratios and Proportions	7.RP.1 7.RP.2 7.RP.3 7.NS.5 7.EEI.4 7.GM.1	Content Standards with Clarifying Notes	Prior Knowledge Required for this Unit	Potential Instructional Strategies/Lessons
		New Academic Vocabulary	Subsequent Knowledge Related to this Unit	Resources
			Relationship Among Standards in this Unit	Sample Formative Assessment Tasks/Questions
Geometry	7.GM.1 7.GM.2 7.GM.3	Content Standards with Clarifying Notes	Prior Knowledge Required for this Unit	Potential Instructional Strategies/Lessons
		New Academic Vocabulary	Subsequent Knowledge Related to this Unit	Resources
			Relationship Among Standards in this Unit	Sample Formative Assessment Tasks/Questions

Table of Contents (Continued)

Algebraic Geometry	7.GM.4 7.GM.5 7.GM.6 7.EEI.4b	Content Standards with Clarifying Notes	Prior Knowledge Required for this Unit	Potential Instructional Strategies/Lessons
		New Academic Vocabulary	Subsequent Knowledge Related to this Unit	Resources
			Relationship Among Standards in this Unit	Sample Formative Assessment Tasks/Questions
Statistics	7.DSP.1 7.DSP.2 7.DSP.3 7.DSP.4	Content Standards with Clarifying Notes	Prior Knowledge Required for this Unit	Potential Instructional Strategies/Lessons
		New Academic Vocabulary	Subsequent Knowledge Related to this Unit	Resources
			Relationship Among Standards in this Unit	Sample Formative Assessment Tasks/Questions
Probability	7.DSP.5 7.DSP.6 7.DSP.7 7.DSP.8	Content Standards with Clarifying Notes	Prior Knowledge Required for this Unit	Potential Instructional Strategies/Lessons
		New Academic Vocabulary	Subsequent Knowledge Related to this Unit	Resources
			Relationship Among Standards in this Unit	Sample Formative Assessment Tasks/Questions

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Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7
Rational Numbers	Expressions and Equations	Ratios and Proportions	Geometry	Algebraic Geometry	Statistics	Probability
Standards	**Standards**	**Standards**	**Standards**	**Standards**	**Standards**	**Standards**
7.NS.1	7.EEI.1	7.RP.1	7.GM.1	7.GM.4	7.DSP.1	7.DSP.5
7.NS.2	7.EEI.2	7.RP.2	7.GM.2	7.GM.5	7.DSP.2	7.DSP.6
7.NS.3	7.EEI.3	7.RP.3	7.GM.3	7.GM.6	7.DSP.3	7.DSP.7
	7.EEI.4	7.NS.5		7.EEI.4b	7.DSP.4	7.DSP.8
	7.EEI.5	7.EEI.4				
	7.NS.4	7.GM.1				

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Mathematical Process Standards: The South Carolina College- and Career-Ready (SCCCR) Mathematical Process Standards demonstrate the ways in which students develop conceptual understanding of mathematical content and apply mathematical skills. As a result, the SCCCR Mathematical Process Standards should be integrated within the SCCCR Content Standards for Mathematics for each grade level and course. Since the process standards drive the pedagogical component of teaching and serve as the means by which students should demonstrate understanding of the content standards, the process standards must be incorporated as an integral part of overall student expectations when assessing content understanding.

1. **Make sense of problems and persevere in solving them.** a. Relate a problem to prior knowledge. b. Recognize there may be multiple entry points to a problem and more than one path to a solution. c. Analyze what is given, what is not given, what is being asked, and what strategies are needed, and make an initial attempt to solve a problem. d. Evaluate the success of an approach to solve a problem and refine it if necessary.	5. **Use a variety of mathematical tools effectively and strategically.** a. Select and use appropriate tools when solving a mathematical problem. b. Use technological tools and other external mathematical resources to explore and deepen understanding of concepts.
2. **Reason both contextually and abstractly.** a. Make sense of quantities and their relationships in mathematical and real-world situations. b. Describe a given situation using multiple mathematical representations. c. Translate among multiple mathematical representations and compare the meanings each representation conveys about the situation. d. Connect the meaning of mathematical operations to the context of a given situation.	6. **Communicate mathematically and approach mathematical situations with precision.** a. Express numerical answers with the degree of precision appropriate for the context of a situation. b. Represent numbers in an appropriate form according to the context of the situation. c. Use appropriate and precise mathematical language. d. Use appropriate units, scales, and labels.
3. **Use critical thinking skills to justify mathematical reasoning and critique the reasoning of others.** a. Construct and justify a solution to a problem. b. Compare and discuss the validity of various reasoning strategies. c. Make conjectures and explore their validity. d. Reflect on and provide thoughtful responses to the reasoning of others.	7. **Identify and utilize structure and patterns.** a. Recognize complex mathematical objects as being composed of more than one simple object. b. Recognize mathematical repetition in order to make generalizations. c. Look for structures to interpret meaning and develop solution strategies.
4. **Connect mathematical ideas and real-world situations through modeling.** a. Identify relevant quantities and develop a model to describe their relationships. b. Interpret mathematical models in the context of the situation. c. Make assumptions and estimates to simplify complicated situations. d. Evaluate the reasonableness of a model and refine if necessary.	

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Unit Title
Rational Numbers
Content Standards with Clarifying Notes
Open bullets indicate clarifying notes.

- 7.NS.1 Extend prior knowledge of operations with positive rational numbers to add and to subtract all rational numbers and represent the sum or difference on a number line.
    a. Understand that the additive inverse of a number is its opposite and their sum is equal to zero.
    b. Understand that the sum of two rational numbers ($p + q$) represents a distance from p on the number line equal to $|q|$ where the direction is indicated by the sign of q.
    c. Translate between the subtraction of rational numbers and addition using the additive inverse, $p - q = p + (-q)$.
    d. Demonstrate that the distance between two rational numbers on the number line is the absolute value of their difference.
    e. Apply mathematical properties (e.g., commutative, associative, distributive, or the properties of identity and inverse elements) to add and subtract rational numbers.
    ○ Understand, apply, and explain the additive inverse
    ○ Model addition and subtraction of rational numbers, including integers, decimals, and fractions using visual models
- 7.NS.2 Extend prior knowledge of operations with positive rational numbers to multiply and to divide all rational numbers.
    a. Understand that the multiplicative inverse of a number is its reciprocal and their product is equal to one.
    b. Understand sign rules for multiplying rational numbers.
    c. Understand sign rules for dividing rational numbers and that a quotient of integers (with a non-zero divisor) is a rational number.
    d. Apply mathematical properties (e.g., commutative, associative, distributive, or the properties of identity and inverse elements) to multiply and divide rational numbers.
    e. Understand that some rational numbers can be written as integers and all rational numbers can be written as fractions or decimal numbers that terminate or repeat.
    ○ Understand, apply, and explain the multiplicative inverse
    ○ Model multiplication and division of rational numbers, including integers, decimals, and fractions using visual models
    ○ Explain why division by zero is undefined
- 7.NS.3 Apply the concepts of all four operations with rational numbers to solve real-world and mathematical problems.
    ○ Model and solve real-world problems using numbers and operations
    ○ Explain the solution to a real-world problem in the context of the problem
    ○ Interpret the reasonableness of solutions in the context of the problem

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New Academic Vocabulary for This Unit
● Integer
● Positive
● Negative
● Additive inverse
● Zero pairs
● Multiplicative inverse
● Terminating decimal
● Repeating decimal

Prior Knowledge Required for this Unit
● Fluent with operations of positive rational numbers (4.NSBT.4, 5.NSBT.5, 5.NSF.1, 5.NSF.4, 6.NS.1, 6.NS.2, 6.NS.3)
● Understand and perform operations using absolute value (6.NS.7)
● Fluent understanding of mathematical properties (e.g., commutative associative, distributive, or the properties of identity and inverse elements)(3.ATO.5, 4.NSBT.6, 5.NSBT.6, 6.EEI.3, 6.EEI.4)
● Fluent with the Order of Operations with positive rational numbers (3.ATO.8, 4.ATO.3, 5.ATO.1, 6.EEI.1, 6.EEI.2)

Subsequent Knowledge Related to this Unit
This unit will lead to mastery of the Order of Operations involving the fraction bar as a grouping symbol with integers in Grade 7. These standards will also guide students when solving expressions, equations, and inequalities with rational coefficients. The introduction of terminating and repeating decimals will extend to an understanding of 7.NS.5 involving the translation among multiple representations of rational numbers excluding a repeating decimal to a fraction. In Grade 8, students will continue to solve linear equations and inequalities with rational numbers; mastery of these skills will lay a strong foundation for success in high school math courses. In Grade 8, students will extend their knowledge to multiple representations of rational and irrational numbers.

Relationship Among Standards in this Unit
Standards in this unit are all necessary to develop computational skills necessary for work with rational numbers.

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Potential Instructional Strategies/Lessons

- Visual models
  - Two color counters
  - Addition and Subtraction
    - Heaps and Holes: Explain to your students that +1 is like a pile (or heap) of sand on a level beach. A hole of equivalent size dug into the beach represents -1. This model explains positives as a surplus and negatives as a deficit. (See page 9)
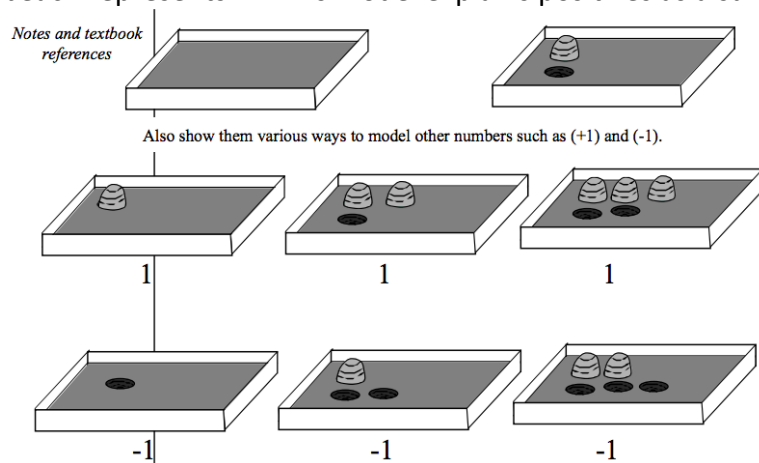
      Source: NC Grade 7 Classroom Strategies

  - Multiplication

    Source: Brain Camp

  - Number line (horizontal and vertical)

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- Tracking Text: This strategy is used to process a word problem. The process entails underlining essential information needed to solve the given problem, including the labels as well as circling important math terms and renaming them with known vocabulary to assist in understanding what process to follow when solving for the answer.

Example: When the navy wants to test the depth of a submarine they complete

the following steps. First they take the submarine to a depth of 150 meters

negative

positive

below sea level followed by moving up towards the surface 100 meters. The final

negative

step is to go deeper another 350 meters from where they were. How deep will

the submarine be after this series of movements under water?

-150m + 100m + (− 350m)

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Resources
6–8 Progression on The Number System; High School, Number - http://commoncoretools.me/wp-content/uploads/2013/07/ccssm_progression_NS+Number_2013-07-09.pdf *Elementary and Middle School Mathematics: Teaching Developmentally*, Eighth Edition (older editions can be used as well) By John A. Van de Walle, Karen S. Karp, and Jennifer M. Bay-Williams ISBN-10: 0132612267; ISBN-13: 9780132612265 7.NS.1 - Through this unit, students will be able to analyze the addition and subtraction of integers by discussing the rise and fall of a hot air balloon. http://www.supermathunits.com/files/hot_air_ballon_unit.pdf 7.NS.2 - This document provides station-based activities for the classroom to assist students with the multiplication and division of rational numbers. http://moodle.wbrschools.net/pluginfile.php/3830/mod_resource/content/1/Set%202%20Multiplying%20and%20Dividing%20Rational%20Numbers.pdf 7.NS.1- 7.NS.3 - This Jeopardy game provides students with a computational review of operations with rational numbers. http://www.math-play.com/7th-Grade-Numbers-and-Operations-Jeopardy/7th-Grade-Numbers-and-Operations-Jeopardy.html
Sample Formative Assessment Tasks/Questions
Performance Task 7.NS.1: Jennifer decided to open a bank account with $150. On Monday she made a deposit of $25. The following week she made a withdrawal of $150. The next month there was an emergency and she needed to withdraw $200. After this last withdrawal does Jennifer have a positive or negative balance? Explain. Answer: Jennifer would have a negative balance in her account after the last withdrawal. You find this out by adding $25 to $150 to get a balance of $175. You then subtract the withdrawal of $150 from $175 to get a balance of $25. Finally you would subtract $200 from $25 to get a negative balance of -$175.

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Performance Task 7.NS.2: A water well drilling rig has dug 60 feet below the surface of the water after one full day (24 hrs) of continuous use. A. Assuming the rig drilled at a constant rate, what was the height of the drill after 15 hours?

Answer: -37.5 feet B. If the rig has been running constantly and is currently at a height of -143.6 feet, for how long has the rig been running?
Answer: approximately 2.93 hours

Performance Task 7.NS.2: The cheerleaders at a local middle school want new uniforms for the yearly cheerleading competition in South Carolina. A parent donated 20 ¾ yards of material. If each uniform takes ⅞ yard to make, how many uniforms can they make from the donated material? Explain your reasoning.

Answer: 23 uniforms - If the total yardage is 20 ¾ yards and each uniform requires ⅞ yard, you must divide 20 ¾ by ⅞. The answer is 23 5/7 but because we are talking about uniforms, only 23 uniforms can be made from the material.

Performance Task 7.NS.3: Justin has two dogs, Finley and Noni. Each day Finley eats ⅓ of a can of dog food, and Noni eats ⅘ of a can. Dog food is only sold in 4 can packages, and each package costs $3. How much will Justin pay for a 30 day supply of dog food? Justify your reasoning.

Answer: $27 - First, students must determine how many cans of dog food Justin will need for 30 days. By multiplying ⅓ of a can by 30 days, we see Finley requires 10 cans of dog food. By doing the same with ⅘ of a can and 30 days, we see Noni needs 24 cans of dog food. This means Justin will need 34 total cans of dog food for 30 days. If he can only buy cans of dog food in packs of 4, students must divide 4 into 34 to determine how many packages Justin must buy. The resulting quotient is 8 ½; however, individuals cannot buy partial packages of dog food. Therefore, Justin must buy 9 packages of dog food at $3 per package for a total price of $27.

Performance Task 7.NS.3: During this task, students will solve real-world and mathematical problems involving the four operations with rational numbers. They will also translate those operations into words/stories.

7.NS.3 Lesson Iced
Tea Stand.doc

Performance Task 7.NS.3: A 20-foot piece of rope will be cut into as many 1 ½ foot sections as possible. How much rope will be left over?

Answer: 6 inches; ½ foot

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Unit Title
Expressions and Equations
Content Standards with Clarifying Notes
Open bullets indicate clarifying notes.

- 7.EEI.1 Apply mathematical properties (e.g., commutative, associative, distributive) to simplify and to factor linear algebraic expressions with rational coefficients.
  - Use properties to simplify and factor algebraic expressions, including those with rational coefficients
  - Use the greatest common factor to factor algebraic expressions
  - Foundational formulas (e.g., perimeter, area) should be used to extend knowledge of algebraic expressions
- 7.EEI.2 Recognize that algebraic expressions may have a variety of equivalent forms and determine an appropriate form for a given real-world situation.
  - Describe real-world situations and determine the appropriate form of an algebraic expression (e.g., $2(x+4)$ or $2x+8$)
- 7.EEI.3 Extend previous understanding of Order of Operations to solve multi-step real-world and mathematical problems involving rational numbers. Include fraction bars as a grouping symbol.
  - Understand that the fraction bar implies parentheses for the numerator
  - Order of Operations should include multiplication and division of rational numbers, including integers, decimals, and fractions
- 7.EEI.4 Apply the concepts of linear equations and inequalities in one variable to real-world and mathematical situations.
  - a. Write and fluently solve linear equations of the form $ax + b = c$ and $a(x + b) = c$ where a, b, and c are rational numbers.
  - b. Write and solve multi-step linear equations that include the use of the distributive property and combining like terms. Exclude equations that contain variables on both sides.
  - c. Write and solve two-step linear inequalities. Graph the solution set on a number line and interpret its meaning.
  - d. Identify and justify the steps for solving multi-step linear equations and two-step linear inequalities.
  - Equations must remain balanced
  - Use Order of Operations in the reverse order to isolate the variable
- 7.EEI.5 Understand and apply the laws of exponents (i.e., product rule, quotient rule, power to a power, product to a power, quotient to a power, zero power property) to simplify numerical expressions that include whole-number exponents.
  - Understand that a number raised to a power of zero results in a value of 1, not 0
  - Derive the laws of exponents (i.e., product rule, quotient rule, power to a power, product to a power, quotient to a power, zero power property) before applying the laws in numerical expressions

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- 7.NS.4 Understand and apply the concepts of comparing and ordering to rational numbers.
    a. Interpret statements using less than ($<$), greater than ($>$), less than or equal to ($\leq$), greater than or equal to ($\geq$), and equal to ($=$) as relative locations on the number line.
    b. Use concepts of equality and inequality to write and explain real-world and mathematical situations.
    o Understand that a closed circle represents the rational number and an open circle will not represent the rational number when graphing an inequality
    o Focus on real-world situations including vocabulary for less than or equal to ($\leq$) and greater than or equal to ($\geq$)

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New Academic Vocabulary for This Unit
- Product Rule   - Quotient Rule   - Power to a Power   - Product to a Power   - Quotient to a Power   - Zero Power Property   - Greater than or Equal to   - Less than or Equal to

Prior Knowledge Required for this Unit
- Evaluate numerical expressions involving grouping symbols (5.ATO.1)   - Write and evaluate numerical and algebraic expressions with whole number exponents and positive rational numbers (6.EEI.1, 6.EEI.2)   - Apply mathematical properties to generate and justify equivalent expressions (6.EEI.3, 6.EEI.4)   - Calculate the greatest common factor of two numbers less than or equal to 100 (6.NS.4)

| Subsequent Knowledge Related to this Unit |
|---|
| In Grade 8, students will extend knowledge of the Laws of Exponents to include numerical expressions with integer exponents. In high school courses, students will apply the Laws of Exponents with rational exponents and algebraic expressions. Additionally in Grade 8, students will solve multi-step equations with variables on both sides of the equal sign. Grade 7 students will use their complete understanding of the Order of Operations and their properties to lay a foundation for functions in Grade 8. |

Relationship Among Standards in this Unit
Standards in this unit are all necessary to develop the computational skills needed for work within the real number system including solving multi-step linear equations and inequalities and simplifying expressions which include the use of whole-number exponents.

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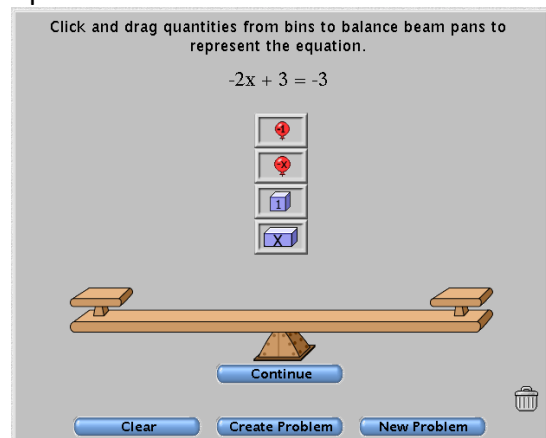Return to Middle School Overview or Table of Contents

Potential Instructional Strategies/Lessons

- Algebra Tiles
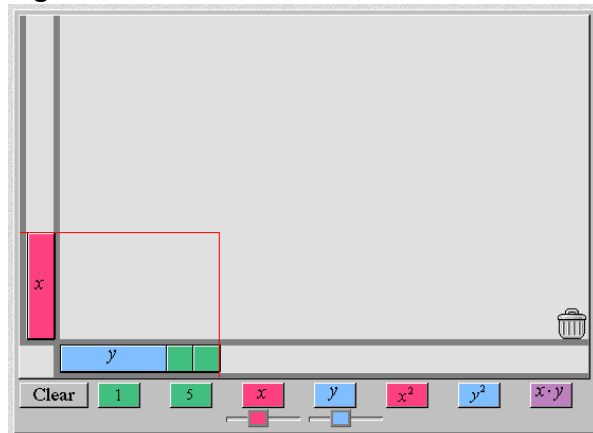
Source: National Library of Virtual Manipulatives

- Equations Balance

Source: National Library of Virtual Manipulatives

- Hands-on Equations

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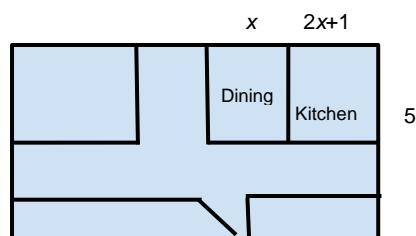| Resources |
| --- |
| Progression document for Grade 6- Grade 8 expressions and equations: https://commoncoretools.files.wordpress.com/2011/04/ccss_progression_ee_2011_04_25.pdf

 Solving multi-step equations: http://illuminations.nctm.org/Activity.aspx?id=3482 : this website allows the students to solve multi step equations using algebra tiles.

 7.EEI.2 - Balance Expressions - http://illuminations.nctm.org/Lesson.aspx?id=2747

 7.EEI.2 - This website demonstrates how to derive the laws of exponents. Use this website as a guide for lesson planning. http://www.mathsisfun.com/algebra/exponent-laws.html

 7.EEI.4 - This website provides a Jeopardy review game for students to practice the skills involved in solving multi-step equations and simplifying expressions. https://jeopardylabs.com/play/solving-multi-step-equations1 |

Sample Formative Assessment Tasks/Questions
Performance Task 7.EEI.1: The Martin family is remodeling their home. They are removing the wall between the kitchen and the dining room. Use the model below to determine the area of the new room.   Answer: 15x + 5 square units - Since the wall is being removed between the dining room and kitchen, students should add the lengths "x" and "2x+1" to determine the length of the newly formed room: 3x + 1 units. To determine the area, students must multiply the length by the width (or base by the height), so they should use the given width of 5 units, which is consistent for both the dining room and kitchen. By multiplying 5 by 3x + 1, it can be determined that the area of the newly formed room is 15x + 5 square units.

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Performance Task 7.EEI.1: This task will assess students' knowledge of formulating an algebraic expression based on a real-life situation

The Quilt of a Math
Teacher.pdf

Source: New York City Department of Education

Performance Task 7.EEI.2: This task has students become the business owner of a store and business is a little slow. Since a sale is the best way to attract customers, they have to determine which sale is best and justify their reasoning.

7.EE.A.2 Task Shop
Smart.doc

Performance Task 7.EEI.3: In this task, students will use formulas to compute the number of points each player and team totals in an NFL Weekend for a fantasy football league.

Fantasy Football
Task.pdf

Source: Yummy Math

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Performance Task 7.EEI.4: Thompsons Water Retreats rents boats for weekend trips. Each boat can carry 1742 pounds of people and luggage. The average weight of a person is 153 pounds, and each person brings a 40 pound suitcase.

Write an inequality to describe the restrictions on the number of people possible in a boat.
   a. What is the maximum number of people that can rent a boat together?
   b. Several families want to rent boats for July 4th. The first family has 4 people, the second has 11 people, and a third has 9. Which groups, if any, can rent a boat?
   c. Construct a graph to represent the solution set.

   Answers:
   a. $x(153 + 40) \leq 1742$ or $193x \leq 1742$
   b. 4 people - yes; 11 people - no; 9 people -yes - By solving for x, one gets the answer $x \leq 9.03$; this means total family members on the boat must be less than this number.
      9 people - If $x \leq 9.03$, then a maximum of 9 people can be on the boat together.

   c.
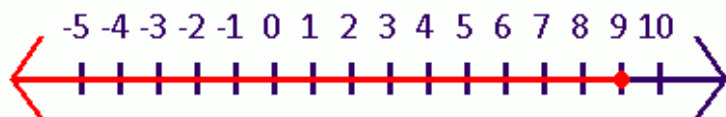
Performance Task 7.EEI.4: This task challenges a student to use algebra to represent, analyze, and generalize a variety of functions including linear relationships.

Toy Trains.pdf

Source: Mathematics Assessment Resource Service

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Performance Task 7.EEI.5: Solve the following expression: $\dfrac{3^0 \cdot (4^2)2}{2^2 \cdot 2^2}$

Answer: the solution to this question is 2. The first step would be to square 4 and get the value 16 and to rewrite the denominator as 2^4. Next would be to evaluate 3^0 as 1 and evaluate 2^4 as 16. Finally in the numerator multiply 16 and 2 to get 32 then divide 32 by 16 and get the final answer 2.

Performance Task 7.NS.4: Camille, the band director for the Middletown High School marching band, is buying instruments to expand the brass section. A tuba costs $960. The total expenditure must be below $2,700.

Write an inequality that describes this situation. Use the given numbers and the following variable.
x = the number of tubas purchased

Answer: $960x < 2700$

Performance Task 7.NS.4: Ning is printing out copies of a presentation. It takes 5 minutes to print a color copy. He wants to spend a maximum of 50 minutes on printing.

Write an inequality that describes this situation. Use the given numbers and the following variables.
x = the number of color copies

Answer: $5x \leq 50$